

इंटरनेट

मानक

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Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

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Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 7587-6 (2006): Cage Suspension Gear for Winding in Mines, Part 6: Safety Detaching Hooks (4 Plates Type) [MED 8: Mining Techniques and Equipment]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

खानों में वाईंडिंग के लिए केज सस्पेंशन गियर — विशिष्टि

भाग 6 सुरक्षा वियोजन हुक (4 प्लेट टाइप) 80 और

100 kN क्षमता वाले

(पहला पुनरीक्षण)

Indian Standard

**CAGE SUSPENSION GEAR FOR WINDING IN
MINES — SPECIFICATION**

**PART 6 SAFETY DETACHING HOOKS (4 PLATES TYPE)
80 AND 100 kN CAPACITY**

(First Revision)

ICS 73.100.40

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (Part 6) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Mining Techniques and Equipment Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published as IS 3970 : 1967 'Safety detaching hooks used in mines'. With the experience gained over the years, a necessity on safety hooks was felt for incorporating the dimensions of the safety hook and for corresponding detaching plate in the standard. To specify these dimensional details the standard was published as IS 7587 (Part 6) : 1984 superseding IS 3970 : 1967. In addition, a detaching test was also incorporated to test the proper functioning of the safety hook in the event of over wind. This standard also covers the top and bottom connecting shackles and pins used to connect the safety hook to other components of the cage suspension gear.

Further experience gained in implementing the standard has necessitated this revision.

Safety hook is a component of cage suspension gear and is used to connect rope cappel to the other components of the cage suspension gear.

30 and 50 kN capacity safety detaching hooks have been deleted. Minimum capacity safety detaching hook is 80 kN. Even if any user wants to use 50 kN cappel and safety detaching hook, 50 kN cappel shall be fitted with 80 kN safety detaching hook. This has been done to increase the clearance between the cappel and the hole of the catch plate to avoid collision during violent over winding of cages.

This standard on the cage suspension gear is issued in eight parts. The other parts in this series are:

- Part 1 General requirements
- Part 2 Cappels
- Part 3 Shackles and pins
- Part 4 Bridle chains
- Part 5 Distribution plates
- Part 7 Safety detaching hooks (4 plates type) 120,150 and 200 kN capacity
- Part 8 Clivey hook suspension arrangements

The composition of the Committee responsible for the formulation of this standard is given in Annex C.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CAGE SUSPENSION GEAR FOR WINDING IN MINES — SPECIFICATION

PART 6 SAFETY DETACHING HOOKS (4 PLATES TYPE) 80 AND 100 kN CAPACITY

(*First Revision*)

1 SCOPE

1.1 This standard (Part 6) covers the requirements for safety detaching hook (4 plates type) 80 and 100 kN capacity used in cage suspension gear for winding in mines.

1.2 It also covers top, bottom, lifting shackles and pins used with detaching hooks.

2 REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	Title
191 (Parts 1 to 10) : 1980	Copper (<i>third revision</i>)
1148 : 1982	Hot rolled rivet bars (up to 40 mm dia) for structural purposes (<i>third revision</i>)
1367 (Part 2) : 2002	Technical supply conditions for threaded steel fasteners: Part 2 Tolerances for fasteners — Bolts, screws, studs and nuts — Product grades A, B and C (<i>third revision</i>)
1501 : 2002	Method for vickers hardness test for metallic materials (<i>third revision</i>)
3073 : 1967	Assessment of surface roughness
4218	Metric screw threads:
(Part 1) : 2001	Basic and design profiles (<i>second revision</i>)
(Part 2) : 2001	General plan (<i>second revision</i>)
(Part 3) : 2001	Basic dimensions (<i>second revision</i>)
7587 (Part 1) : 2004	Cage suspension gear for winding in mines — Specification : Part 1 General requirements (<i>first revision</i>)

IS No.

Title

9519 : 1980	Dimensions for width across flats for hexagon head bolts and nuts
14962	General purpose metric screw threads — Tolerances:
(Part 1) : 2001	Principles and basic data
(Part 2) : 2001	Limits of sizes for general purpose external and internal screw threads — Medium quality
(Part 3) : 2001	Deviations for constructional screw threads

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Safety Detaching Hook — A safety device fitted to vertical shaft winding installations for the purpose of preventing the cage of skip from being raised beyond a prescribed level in the event of an overwind. A number of designs of safety detaching hooks are in use but the most commonly used hook in Indian mines is explained in Annex A giving its construction and operational requirements.

3.2 Maximum Static Load (Safe Working Load) — The load used as basis in computation of stresses in a safety detaching hook. It shall consist of full suspended mass of a loaded cage or skip or the total loads at the top shackle of the safety hook (*see also* Annex B).

3.3 Proof Load — The non-destructive tensile load to which the hooks are subjected to in the finished condition.

3.4 Breaking Load — The destructive tensile load to which the hooks are subjected to in the finished condition.

3.5 Factor of Safety — The factor of safety is the ratio between the breaking load and the maximum static load as defined in 3.2 and 3.4, respectively.

3.6 Components of Safety Detaching Hook

3.6.1 Striking Horn — A part of inner plates in the

hook to strike the catch plate and cause upper shackle to be released in the event of over wind.

3.6.2 Hinge (Centering) Pin — A pin which allows plates to rotate with respect to each other during operation of the assembly and a load carrying member in the assembly of hook.

3.6.3 Spacer Block — A block of appropriate size and shape to maintain plate clearances in detaching hooks.

3.6.4 Shear Pin — A pin with known shear properties used to hold the hook plates in location when the hook is attached to the upper shackle pin. It shears to release the plates when the hook is pulled into catch plate.

3.6.5 Resetting Pin — A pin which holds a detached hook in the open position.

3.6.6 Detaching Plate or Catch Plate — A plate held by the head frame and designed to cause a selected size and shape of detaching hook to release the upper shackle pin and engage the plate so as to be safely held in the event of an over wind.

3.7 Top Connecting Shackle — A shackle used to connect upper end of safety hook to the lower end of the rope cappel.

3.8 Bottom Connecting Shackle — A shackle used

to connect lower end of safety hook to the upper end of equalizing plate.

3.9 Lifting Shackle — A shackle used after an over wind to release the safety hook, cage and other associated components of cage suspension gear from the catch plate.

4 MATERIAL

The materials for various components of safety detaching hooks shall be as given below:

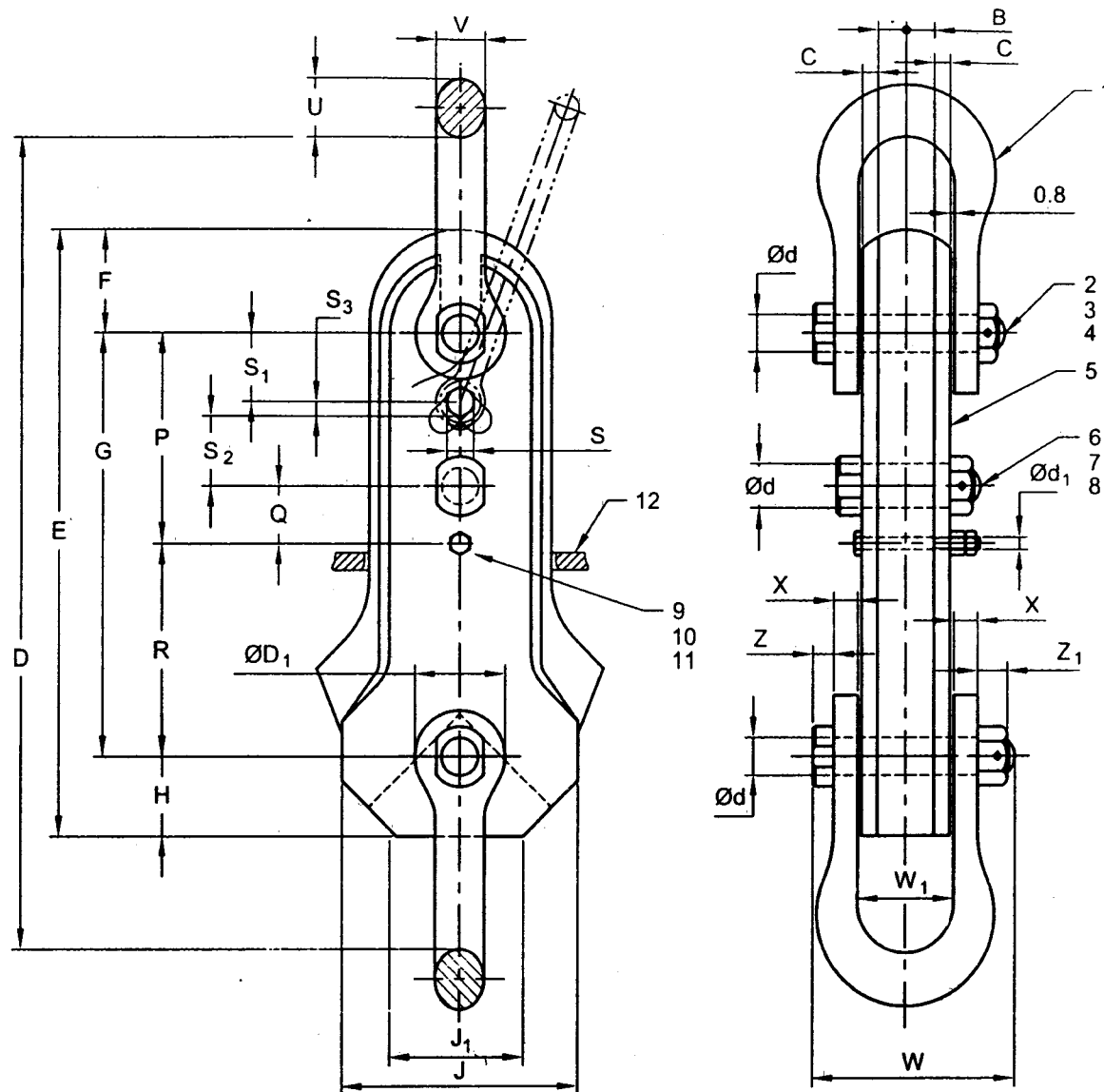
<i>Sl No.</i>	<i>Component</i>	<i>Material</i>
i)	All steel components	As specified in IS 7587(Part 1)
ii)	Spacer block rivets	Rivet bars conforming to IS 1148
iii)	Shear pin	Copper conforming to IS 191(Parts 1 to 10)

5 DIMENSIONS

Dimensions of components of safety detaching hook shall be as given in 5.1 to 5.6.

5.1 Hook Assembly

See Fig. 1.



Component No.	Component Name	Quantity
1	Top and bottom connecting shackle	2
2	Pin for top and bottom connecting shackle	2
3	Nut	2
4	Split pin	2
5	Four plate assembly	1 set
6	Centre pin	1
7	Nut for centre pin	1
8	Split pin for centre pin	1
9	Shearing pin	1
10	Nut for shearing pin	1
11	Lock nut for shearing pin	1
12	Catch plate	1
13	Lifting shackle	1
14	Pin for lifting shackle	1
15	Nut for lifting shackle pin	1
16	Split pin	1

Safe Working Load (SWL) kN	A	B	C	D	Ød	Ød ₁	ØD ₁	E	F	G	H	J	J ₁	P	Q	R	S	S ₁	S ₂	S ₃	U	V	W	X	Z	Z ₁	W ₁
80	178	25	14	708	46	10	88	556	100	380	76	302	230	160	60	160	26	66	80	14	48	41	164	20	18	25	79
100	203	32	16	829	52	12	105	638	114	435	89	343	288	176	70	189	30	69	90	17	57	48	196	25	20	30	97

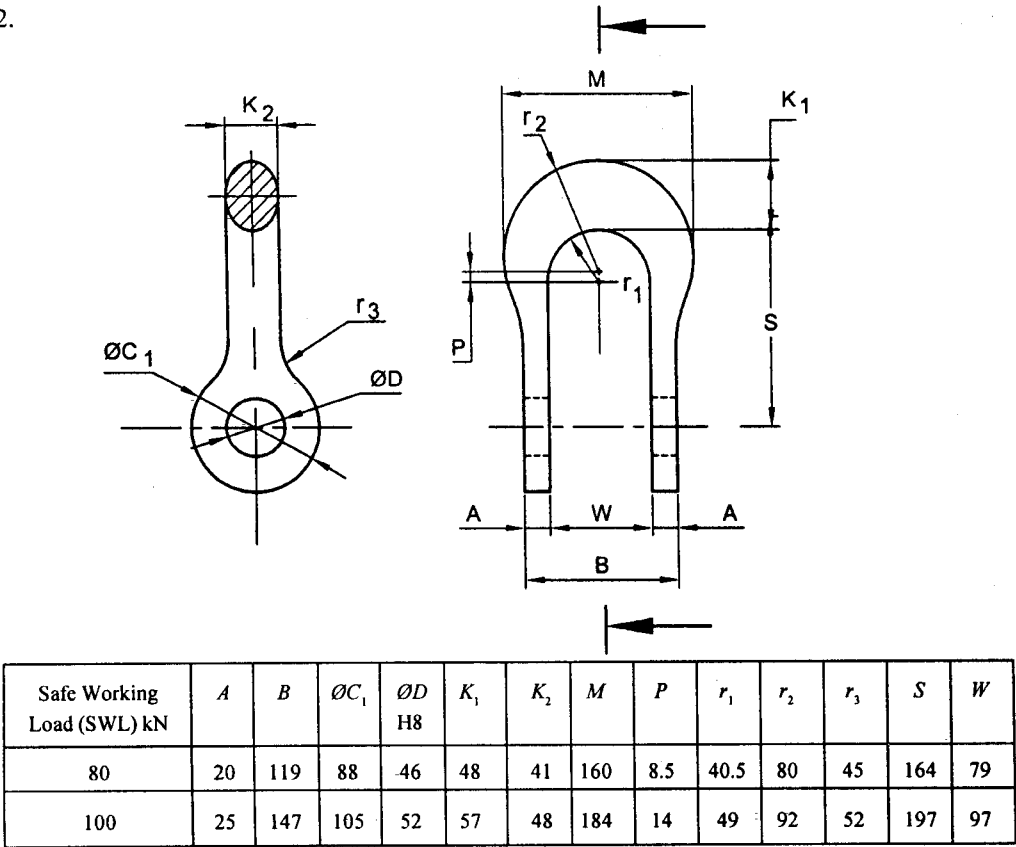
All dimensions in millimetres.

FIG. 1 HOOK ASSEMBLY

5.2 Connecting Shackle — Top and Bottom

5.2.1 Shackles

See Fig. 2.

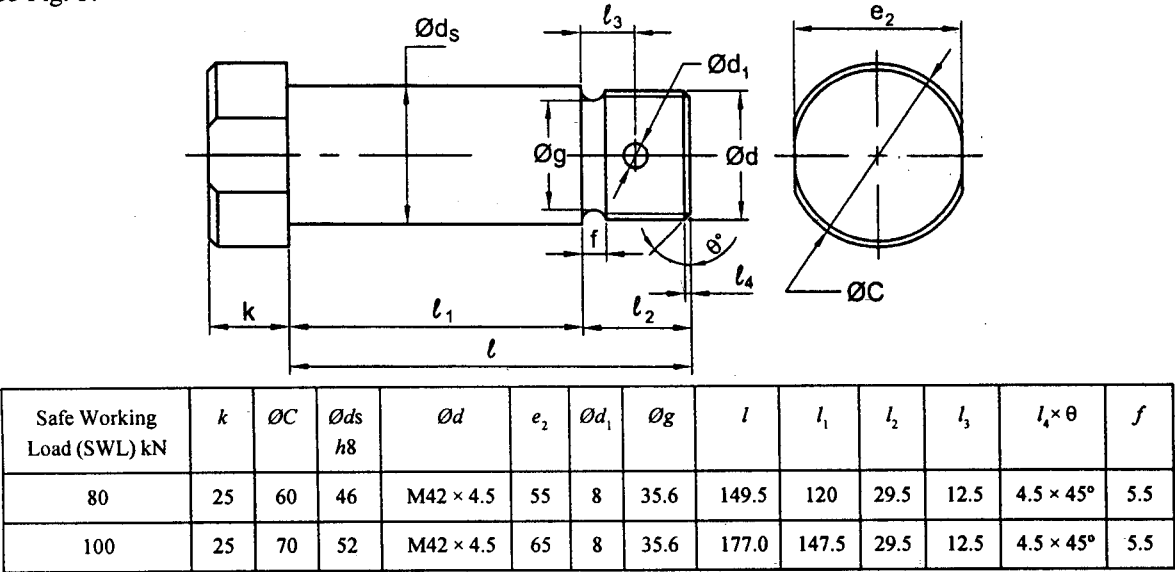


All dimensions in millimetres.

FIG. 2 SHACKLE

5.2.2 Pins — Top and Bottom

See Fig. 3.

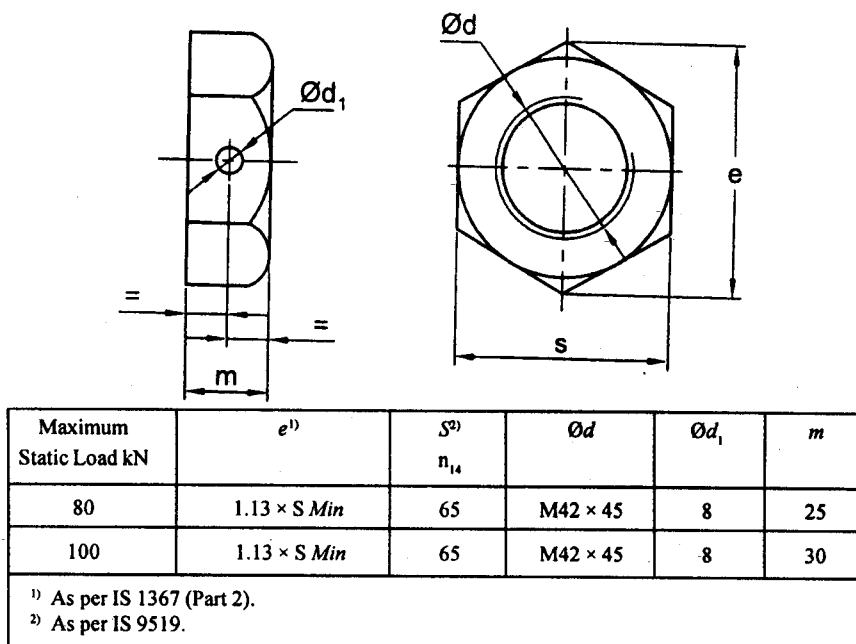


All dimensions in millimetres.

FIG. 3 PINS — TOP AND BOTTOM

5.2.3 Nuts — Top, Bottom and Centre

See Fig. 4.



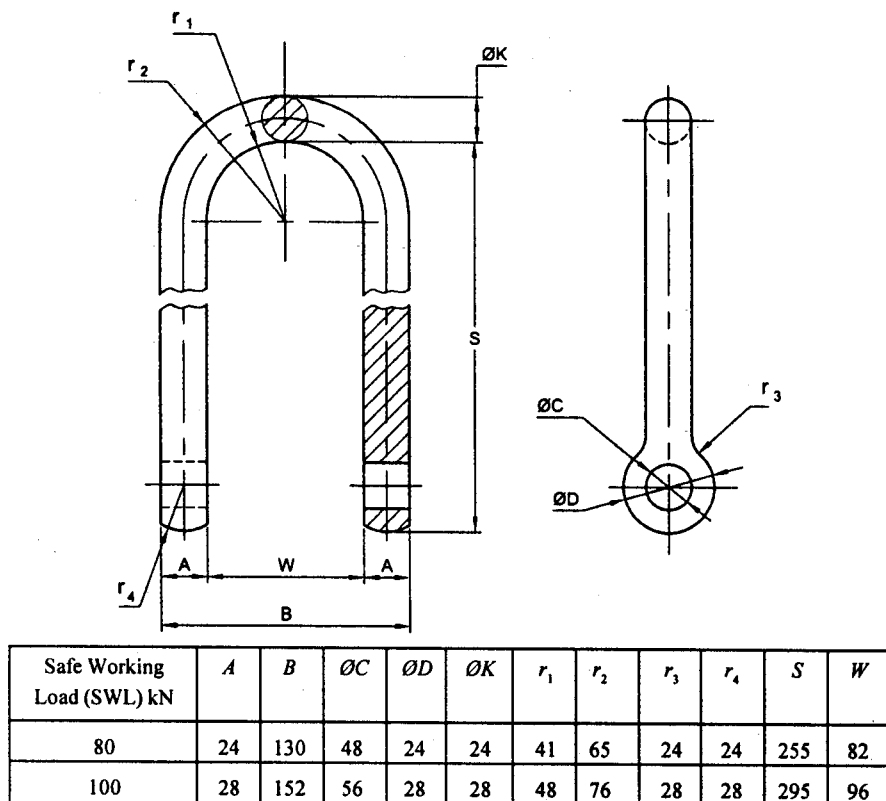
All dimensions in millimetres.

FIG. 4 NUTS — TOP AND BOTTOM

5.3 Lifting Shackles

5.3.1 Shackles

See Fig. 5.

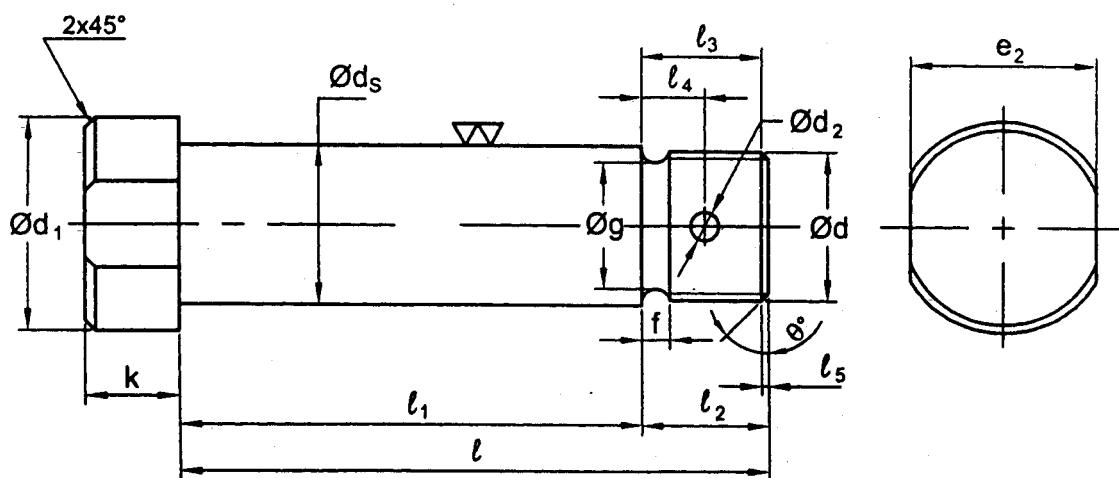


All dimensions in millimetres.

FIG. 5 SHACKLE

5.3.2 *Pin*

See Fig. 6.



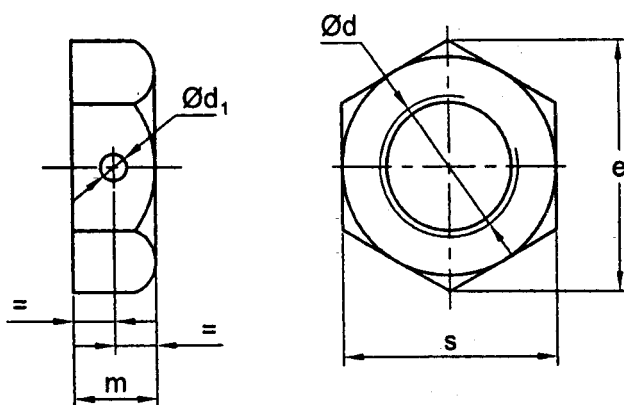
Safe Working Load (SWL) kN	ϕd	ϕd_2	k	ϕd_1	e_2	ϕd_3	ϕg	l	l_1	l_2	l_3	l_4	l_5	f
80	M20 \times 2.5	4	16	37	30	24	16.4	149	130.5	18.5	16	8	2.5 \times 45°	3.2
100	M24 \times 3	6.3	19	44	36	28	19.6	174	152.5	22	19	9.5	3 \times 45°	3.7

All dimensions in millimetres.

FIG. 6 P_{IN}

5.3.3 *Nut*

See Fig. 7.



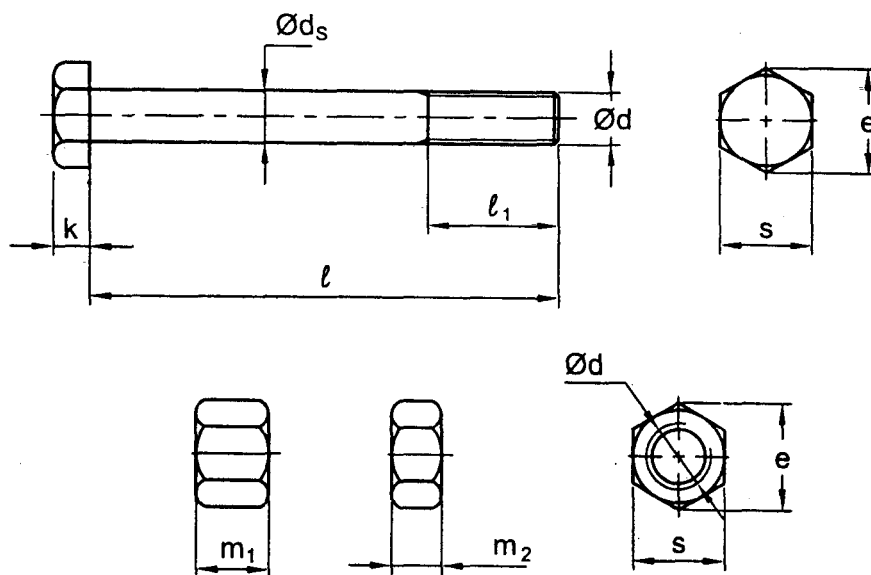
Safe Working Load (SWL) kN	S		m	e	$\varnothing d$	$\varnothing d_1$
80	30	h13	16	$1.13 \times S \text{ Min}$	M20 \times 2.5	4
100	36	h14	19	$1.13 \times S \text{ Min}$	M24 \times 3	6.3

All dimensions in millimetres.

FIG. 7 NUT

5.5 Shearing Pin

See Fig. 9.



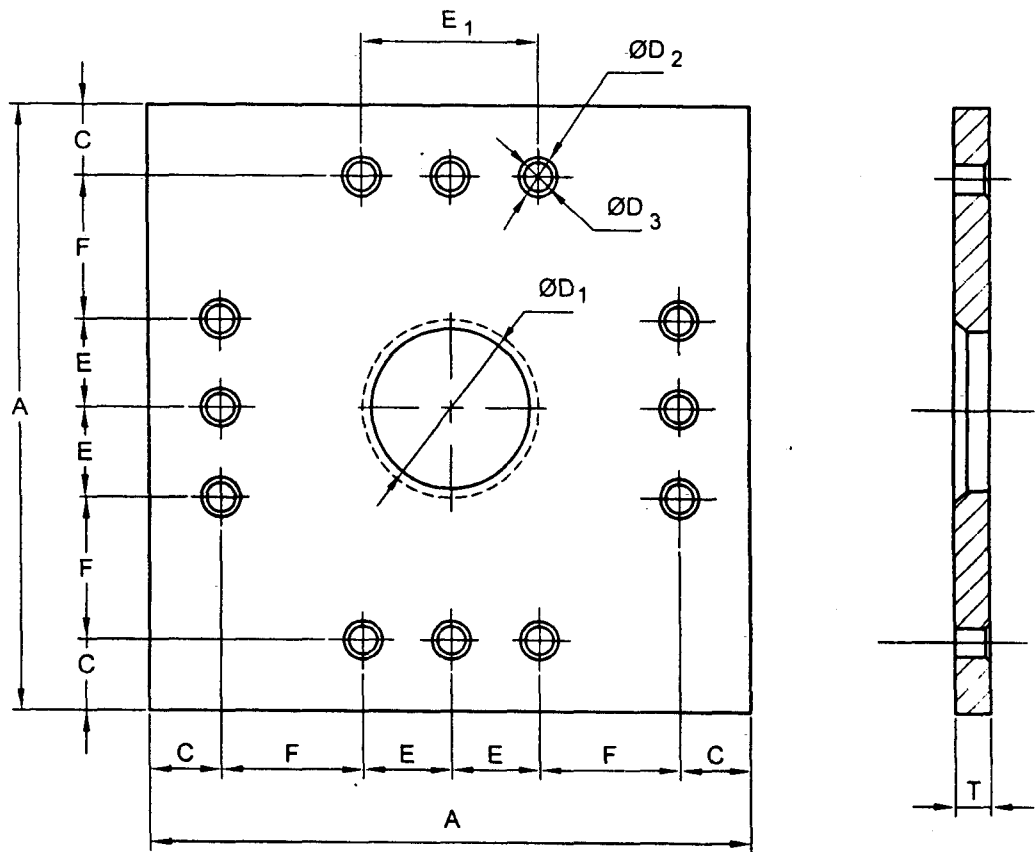
Maximum Static Load, kN	$e^{1)}$	$S^{2)}$	k	$\varnothing d_s$	$\varnothing d$	l	l_1	m_1	m_2
80	$1.13 \times S \text{ Min}$	16	8	10	M10 \times 1.5	100	30	8	8
100	$1.13 \times S \text{ Min}$	20	10	12	M12 \times 1.75	120	35	10	10
¹⁾ As per IS 1367 (Part 2).									
²⁾ As per IS 9519.									

All dimensions in millimetres.

FIG. 9 SHEARING PIN AND NUT

5.6 Catch Plate

See Fig. 10.



Maximum Static Load, kN	A	C	ØD ₁	ØD ₂ /ØD ₃	E	E ₁	F	R	T
80	610	51	181	30/27	These dimensions shall suit customer requirements and shall be drilled at site				25
100	610	51	207	30/27					25

All dimensions in millimetres.

FIG. 10 CATCH PLATE

6 DESIGNATION

A safety detaching hook of 100 kN safe working load manufactured from alloy steel shall be designated as:

Safety Detaching Hook 100 IS 7587-A

NOTE — Symbol 'C' shall be employed for 20C15 steel and symbol 'A' shall be employed for 20Ni2Cr2Mo2 steel.

7 DESIGN

The hook plates shall be so designed that the ratio of d/b (see Fig. 11) is between 1.15 and 1.75 and the ratio of d/y is between 1.15 and 1.28.

8 GENERAL REQUIREMENTS

8.1 Hook Plates and Other Load-Carrying Plates

All load-carrying plates shall comply with the following requirements:

- a) Plates shall be fully machined on both sides to parallel dimensions with a surface roughness grade of N7 (see IS 3073) in the direction normal to the lay and shall be free from any warping, harmful nicks, burrs, deep machining or grinding marks. Plates shall be laid out so that the direction of service tensile stress

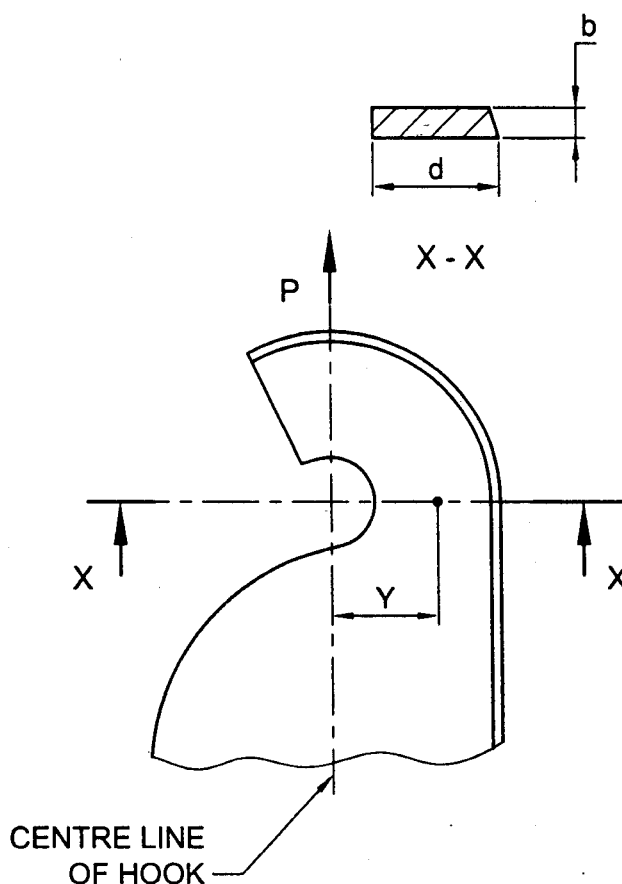


FIG. 11 HOOK PLATE

corresponds to the direction of rolling for the material;

- b) The material required for the manufacture of safety detaching hook plates shall be selected from rolled plates. The shaping of both inner and outer plates may be performed on a flame cutting machine provided that sufficient margin (at least 3 mm or 0.25 times the thickness of plate whichever is greater but not more than 15 mm) is allowed for removal by machining or grinding of any surface marks which may be created as a result of flame cutting operation. If flame cutting is adopted for the profiling of the hook, it is recommended that the inside throat of the hook plate be drilled instead of flame cut. Alternatively, forging may be adopted for profiling of the plates;
- c) Plates shall not be welded;
- d) Through-holes in plates shall be machined to provide true alignment with matching components in the assembly;
- e) All holes shall be accurately reamed to the basic size; and
- f) Prior to final machining and after any profiling, the plate shall be normalized or

hardened and tempered within the temperature range appropriate to the material.

8.2. Hinge Pins

8.2.1 The hinge pin shall be accurately ground to provide a fit as specified in 5.4.1.

8.2.2 The pins shall not be welded.

8.2.3 Prior to final machining, the hinge pins shall be hardened and tempered, within the temperature range appropriate to the material.

8.3 Shear Pins

The shear pins shall be made from rolled bar of pure annealed copper and shall be accurately turned to provide a fit as specified in 5.5.

8.4 Spacer Blocks, Locking Pins and Rivets

Non-load bearing components shall comply with the following requirements:

- a) Spacer blocks shall be machined on both side faces to a smooth finish,
- b) Locking pins and rivets shall be machined to a smooth finish, and

- c) Through-holes in plates and spacer blocks shall be in true alignment.

8.5 Before the assembly of a safety detaching hook, all working parts shall be checked for straightness and gauged for freedom of movement on fulcrum and locking pins, and for the side clearance of the plate.

8.6 Screw Thread

The screw thread on the pins and the nuts shall conform to IS 4218 (Parts 1 to 3) and IS 14962 (Parts 1 to 3).

9 HEAT TREATMENT

The detaching hooks shall be heat-treated in accordance with 5.2 of IS 7587 (Part 1). The hardness when measured in accordance with IS 1501 shall be as given below:

Material	Hardness, HV
20C15	200 to 230
20Ni2Cr2Mo2	250 to 280

10 TESTING

10.1 Prototype Test

Notwithstanding with any provision for statutory requirements, each prototype of the component shall be tested to destruction to ensure the minimum factor of safety of ten in the component. The above test shall be made in a test house approved by the appropriate authority permitting the use of suspension arrangement.

10.2 Detaching Test

Each detaching hook shall be attached to its corresponding correct size of shackle at each end. The detaching hook shall then be loaded with full normal safe working load applied in tension and pulled vertically through a catch plate of the correct size and shape for the hook being tested. The detaching hook shall function correctly, detaching from the upper shackle pin and become securely engaged in the catch plate.

10.3 Proof Load Test

After completion of detaching test (see 10.2) each assembled safety hook complete with top and bottom shackles and shearing pin shall be subjected to tensile proof load as specified in Fig. 1 (see 5.1) and shall satisfactorily withstand the load without any permanent deformation or defect.

10.3.1 Each component shall be separately and thoroughly examined for cracks after proof load test, visually and by means of other suitable devices and shall be found free from defects which could adversely affect the function or mechanical properties of the

detaching hook. Magnetic crack detection test, gamma ray, X-ray and ultrasonic test shall be conducted as required.

10.4 Material Testing

To ensure that safety hook is manufactured from the specified material, sample from 10 percent of the safety hooks shall be subjected to material analysis. Borings/ chips for such analysis shall be taken from the additional material of 20 mm length provided at the inner edge of the striking horn for taking the samples for chemical analysis, micro examination and the grain size of the material used in the manufacture of safety detaching hooks.

11 MARKING

11.1 Identification Marking

Each plate of the safety hook shall be permanent and legibly stamped on non-wearable portion with the manufacturer's identification mark, safe working load, date of manufacture, serial number and the abbreviated name for material.

NOTE — Symbol 'C' shall be employed for 20C15 steel and symbol 'A' for 20Ni2Cr2Mo2 steel.

11.2 The stamps to be used for marking shall be of the following sizes:

Safe Working Load	Size of Mark
kN	mm
80	8

11.3 Inspection Marking

When the test results are found to be satisfactory the representative of testing laboratory approved by approving authority shall immediately stamp the inspection mark on the components.

11.4 BIS Certification Marking

Safety detaching hooks may also be marked with the Standard Mark.

11.4.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which a licence for the use of the Standard Mark may be granted to the manufacturers or producers may be obtained from the Bureau of Indian Standards.

12 PAINTING, PACKING AND SUPPLY

12.1 The components of safety hooks shall be packed supplied with a coat of anticorrosive dressing.

12.2 All components of detaching hooks shall be packed and suitably protected to avoid damage in transit.

12.3 If required by the purchaser a suitable gauge may be supplied with each detaching hook for the purpose of periodical checking for permanent deformation of the hook plates. The gauge shall be accurate to within 0.05 mm.

12.4 An instruction manual giving the details of assembly, erection and maintenance shall be supplied with each detaching hook.

12.5 Each safety hook shall be supplied with top, bottom and lifting shackles and normally with a detaching plate.

13 CERTIFICATE OF TEST

A certificate of test in triplicate shall be furnished by the manufacturer to the purchaser. The certificate shall give the following information.

a) Manufacturer's name,

b) Material,

c) Distinguishing mark,

d) Proof load applied,

e) Safe working load,

f) Factor of safety (as determined by destruction test on prototype),

g) Details of heat treatment adopted and hardness obtained,

h) Report of examination and status of examiners,

j) A declaration that the item supplied complies in all respect with the standard,

k) Details of packing before dispatch, and

m) Details of detaching test.

ANNEX A

(Clause 3.1)

CONSTRUCTION AND OPERATION OF SAFETY DETACHING HOOKS

A-1 CONSTRUCTION OF DETACHING HOOK

The detaching hook (*see* Fig. 12 and 13) consists of four plates; the two outer plates *B* fixed together by rivets passing through a V-shaped spacing block *P* at the lower and two inner plates *A* shaped like a hook at their upper ends. The inner plates are connected together scissor-wise and to the outer plates by the hinge pin *E* at the centre. The lower end of each inner plate is shaped to provide the striking horn *H* and the notched (catch plate) projection *N*. The inner plates have an extra thickness of material in the hook region. With this type of hook, both the inner (hook) plates and the outer (containing) plates are load bearing; the inner plate transmit the load from the top connecting shackle pin *C* to the hinge pin *E* from which point the outer plates transmit the load to the lower shackle pin *C*. The hook is prevented from opening during winding by a shear pin *G* made of copper which is sheared as the hook is drawn through the catch plate.

A-2 OPERATION

A-2.1 Inspection

It is essential that detaching hooks in service, irrespective of the material of which they are manufactured, shall be subjected to a close examination every 12 months and to a field examination every six months.

A-2.1.1 The six monthly examinations in service may take place during six monthly ropes recapping process

or otherwise. The hook shall be completely dismantled, cleaned and examined for any flaws or sign of deterioration utilizing preferably suitable non-destructive testing. Measurement of critical dimensions shall be done and recorded.

A-2.2 Overwinding

In the event of an overwind occurring, the detaching hook shall be withdrawn immediately from service and shall undergo a thorough examination of each part before the unit is placed in service.

A-2.3 Release of Hook After Overwinding

A locking pin shall be inserted between the jaws of inner plates immediately after occurrence of overwind to prevent the unscheduled release of the hook from catch plate. The lifting shackle, attached to the end of wire rope operated by the auxiliary winder is attached to the detaching hook and the complete suspended mass is raised slowly by a small distance. The locking pin, already inserted, is withdrawn and the safety hook including the suspended mass is lowered through the catch plate slowly, to the ground level after closing the jaws of the inner plates.

A-2.4 Accident

In the event of an accident occurring during winding whereby the safety detaching hook becomes over-stretched, it shall be withdrawn from service and subjected to the proof loading test and other non-destructive testing.

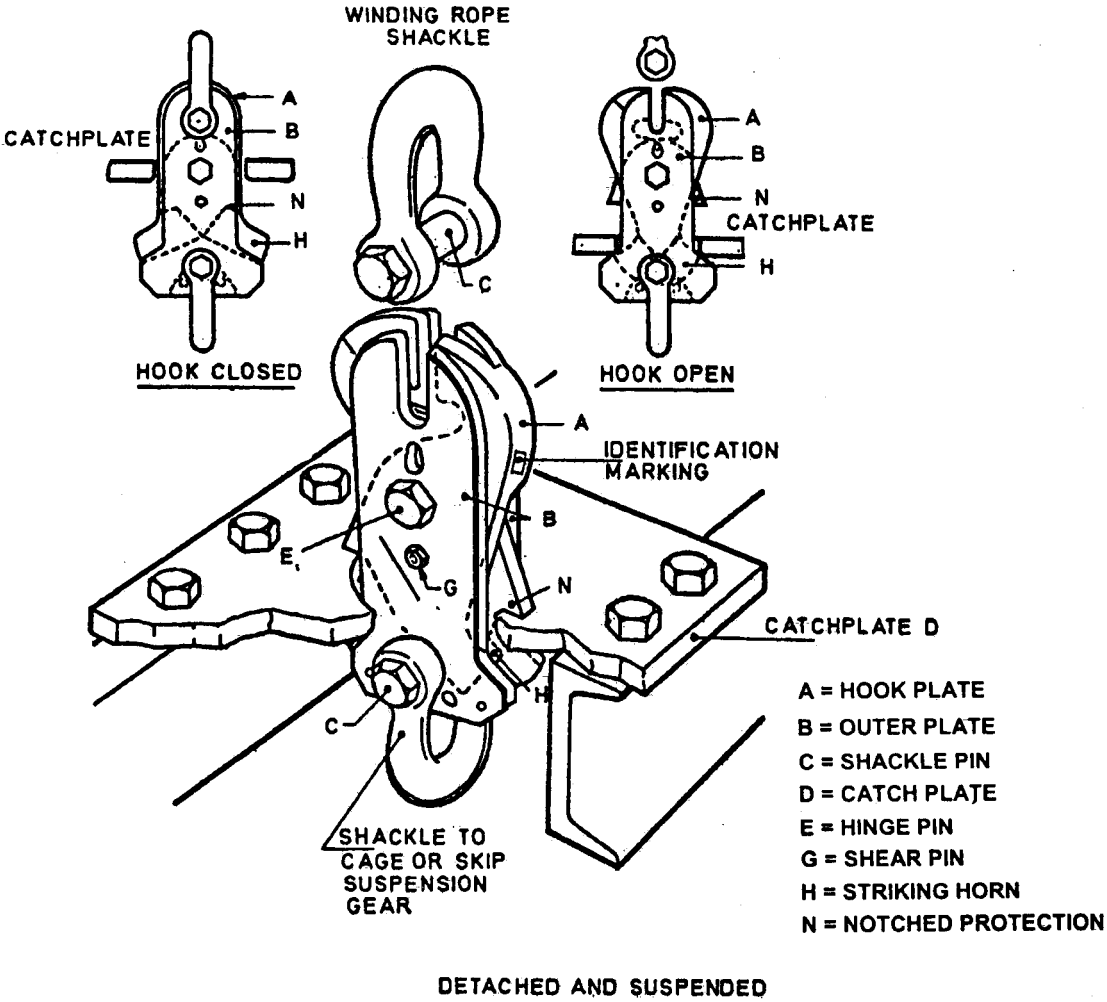


FIG. 12 DETACHING HOOK

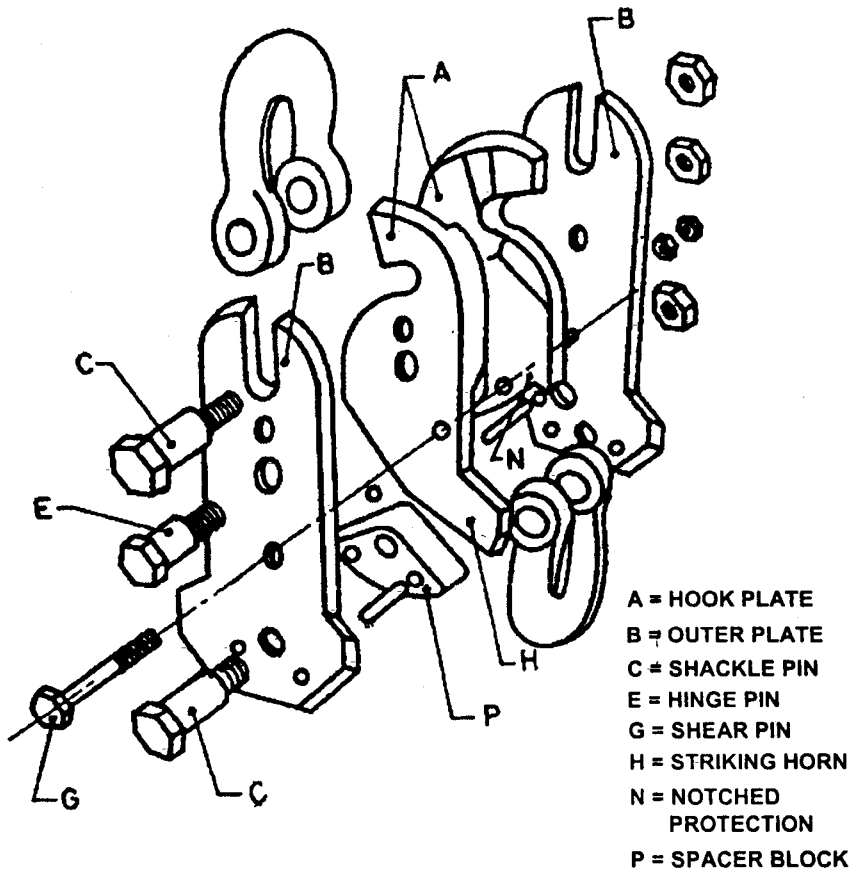


FIG. 13 DETACHING HOOK EXPLODED DIAGRAM

ANNEX B

(Clause 3.2)

STATIC OR SAFE WORKING LOAD

B-1 Safe working load shall consist of:

a) Static load (Winding material)

- 1) Weight of suspension gear;
- 2) Weight of cage;
- 3) Weight of material and its container; and
- 4) Weight of balance rope, if used.

b) Static load (Winding men)

- 1) Weight of suspension gear;
- 2) Weight of cage;
- 3) Weight of men at 75 kg per head; and
- 4) Weight of balance rope, if used.

ANNEX C

(Foreword)

COMMITTEE COMPOSITION

Mining Techniques and Equipment Sectional Committee, ME 08

<i>Organization</i>	<i>Representative(s)</i>
Directorate General of Mines Safety, Dhanbad	SHRI J. P. KASHYUP (<i>Chairman</i>) SHRI P. K. GANGULY (<i>Alternate</i>)
Bharat Coking Coal Ltd, Dhanbad	SHRI RAMJI SAHAY
Bharat Earth Movers Ltd, Bangalore	SHRI V. PALANISWAMY SHRI T. R. LOGANATHAN (<i>Alternate</i>)
Central Coalfields Ltd, Ranchi	CHIEF GENERAL MANAGER (OPERATIONS) CHIEF GENERAL MANAGER (EQUIPMENT) (<i>Alternate</i>)
Central Mine Planning and Design Institute Ltd, Ranchi	SHRI S. K. CHATTERJI SHRI U. ROY (<i>Alternate</i>)
Central Mining Research Institute, Dhanbad	SHRI A. K. GHOSE SHRI S. K. RITOLIA (<i>Alternate</i>)
Eimco Elecon (India) Ltd, Vallabh Vidyanagar	SHRI A. M. DESHPANDE SHRI RAVINDRA LUTHRA (<i>Alternate</i>)
Gujarat Mineral Development Corporation, Ahmedabad	SHRI S. N. MATHUR
Hindalco Industries Ltd, Distt Sonbhadra	SHRI K. K. PATODIA SHRI ASHOK BAMZAI (<i>Alternate</i>)
Hindustan Copper Ltd, Kolkata	SHRI KAMLESH SINGH SHRI O. P. BHARDWAJ (<i>Alternate</i>)
Hindustan Zinc Ltd, Udaipur	SHRI K. C. JAIN
Kapur Mining Equipment Pvt Ltd, Asansol	SHRI DIPAK KAPUR SHRI TAPAN DUTTA (<i>Alternate</i>)
Mahanadi Coalfields Ltd, Dist Sambalpur	SHRI R. B. UPADHYAY SHRI B. P. PATNAIK (<i>Alternate</i>)
Manganese Ore (India) Ltd, Nagpur	SHRI P. M. REDDY SHRI G. WANGNEO (<i>Alternate</i>)
Mecon Ltd, Ranchi	SHRI H. C. MISHRA SHRI H. K. BHANUDEV (<i>Alternate</i>)
Nanda Millar Co, Kolkata	SHRI J. P. GOENKA SHRI PANKAN GOENKA (<i>Alternate</i>)
National Aluminium Co Ltd, Bhubaneswar	SHRI R. C. PATI SHRI C. M. D. MURTHY (<i>Alternate</i>)
National Mineral Development Corporation, Hyderabad	SHRI A. K. GUPTA SHRI C. V. SURESH (<i>Alternate</i>)
South Eastern Coalfields Ltd, Bilaspur	SHRI KAPIL K. RAI
The Eastern Coalfields Ltd, Sanctoria	SHRI S. C. BASU SHRI D. K. ROY (<i>Alternate</i>)
The Hutti Gold Mines Company Ltd, Distt Raichur	DR M. L. PATIL
The Singareni Collieries Co Ltd, Distt Khammam	SHRI K. RAGHAVENDRA RAO SHRI E. RAJA RAO (<i>Alternate</i>)
The Tata Iron and Steel Co Ltd, Distt Dhanbad	SHRI R. S. SINGH SHRI V. K. SRIVASTAVA (<i>Alternate</i>)
TRF Ltd, Jamshedpur	SHRI S. S. MUKHOPADHAY SHRI N. C. GOSWAMI (<i>Alternate</i>)
Western Coalfields Ltd, Nagpur	SHRI A. K. HALDAR SHRI P. S. RAJU (<i>Alternate</i>)
BIS Directorate General	SHRI C. K. VEDA, Scientist 'F' & HEAD (MED) [Representing Director General (<i>Ex-officio</i>)]

*Member Secretary*SHRI T. V. SINGH
Scientist 'E' (MED), BIS

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